CHAPTER 3
AIRWORTHINESS STANDARDS
TRANSPORT CATEGORY ROTORCRAFT

MISCELLANEOUS GUIDANCE (MG)

AC 29 MG 5. AGRICULTURAL DISPENSING EQUIPMENT INSTALLATION.

NOTE: This paragraph has been extensively revised and expanded to clarify the restricted category certification of agricultural dispensing equipment installations on rotorcraft.

a. Explanation. In the early development of the rotorcraft one of its primary usages was agricultural operation. The FAA recognized that the existing requirements, which were designed primarily to establish an appropriate level of safety for passenger-carrying aircraft, imposed an unnecessary economic burden and were unduly restrictive for the manufacture and operation of aircraft intended only for use in rural, sparsely settled areas. Therefore, a special document that established new standards for agricultural dispensing equipment and other special purposes was developed. Restricted Category CAM 8 became effective October 11, 1950.

(1) During the recodification of 1965, CAR 8 ceased to exist as a regulatory basis and selected portions addressing certification were incorporated into FAR 21. While the specific standards in CAR 8 were not changed substantially when adopted into FAR 21, the less restrictive philosophy of CAM 8 and the policy material that was stated in the preamble to CAM 8 were not clearly conveyed.

(2) Advisory material published in 1965 and revised in 1975, summarized the information contained in the advisory portions of CAM 8. This new advisory material indicated that the CAM advisory material would be applicable to the related FAR's. Unfortunately, this document specified that CAM 8 could be used in conjunction with certain FAR's for restricted category certification of small agricultural airplanes only. Rotorcraft were omitted.

(3) A survey of restricted category rotorcraft projects related to agricultural modifications indicates that the CAM 8 philosophy was interpreted to allow the use of AC 43.13-2A structural criteria for most STC's issued through the early 1980's. Since then more restrictive guidance based on CAR 6 and FAR 27 requirements has been applied by some ACO's to several STC applications. Since the more restrictive guidance imposed a significant economic burden on the industry, the HAI requested a meeting with the FAA during the 1990 annual convention in Dallas. As a result of the meeting, an Action Notice to clarify the interpretation of FAR 21.25(a)(1) for restricted category aircraft has been issued.

(4) The following advisory material is a result of a reassessment of past and present policy.

b. Procedures. The certification basis for agricultural dispensing equipment in the restricted category is FAR 21.25(a)(1) as interpreted by Action Notice 8110.22. The accountable Directorate guidance for the substantiation requirements for rotorcraft is as follows:

(1) Substantiation of the agricultural dispensing system hoppers or spray tanks to the load factors provided in figure AC 29 MG 5-1 provides for proof of structure. The load factors of figure AC 29 MG 5-1 address the critical structural load conditions of dispensing equipment mounted in or near the fuselage and provide adequate margins of safety.

FIGURE AC 29 MG 5-1
ACCEPTABLE ULTIMATE LOAD FACTOR FOR
AGRICULTURAL DISPENSING EQUIPMENT DESIGN

	UP	DOWN	SIDE	FORWARD	AFT
Tanks & Equipment Mounted In Or Near The Fuselage	1.5g	4.0g	2.0g	4.0g Note 1	- - - -
Spray Booms	1.5g	2.5g	- - - -	Note 1	2.5g Note 2

Note 1: An ultimate load factor of 2 G's is acceptable for externally side or under fuselage mounted tank and forward mounted spray booms where failure in a minor crash landing will not create a hazard to occupants or prevent exit from the rotorcraft.

Note 2: The aft loads for spray booms may be developed by the applicant based on the 111 percent of V_{NE} for which certification is requested or the load factors of figure AC 29 MG 5-1, whichever is greater.

(2) The applicant may elect to substantiate his/her product by either static or dynamic testing, by analysis, or any combination thereof.

(3) Lower load factors may be used only when justified by manufacturer's data, rational analysis, or actual rotorcraft flight and ground load demonstrations.

(4) Tank pressure test, while not mandated, is recommended for safety reasons. An acceptable procedure is included in paragraph AC 29 MG 5(c)(4).

(5) Dispensing equipment installation attach points. If attach points exist which are an integral part of the rotorcraft and these attach points have been certified to the standard category requirements no further substantiation of the attach point is required

if an analysis indicates the dispensing system does not impose loads which exceed those for standard category certification.

(6) Ground clearance for dispensing equipment installation. A 5-inch ground clearance has typically been used for skid gear equipped rotorcraft which incorporate belly mounted supply tanks/hoppers or systems which have dual side mounted supply tanks/hoppers and the design incorporates cross tubes or other system components which are located beneath the bottom of the fuselage when these components are rigidly attached to the airframe structure. The 5-inch dimension is measured vertically from the ground to the lowest point of the installed system, with the rotorcraft in its operational configuration and gross weight (including disposable load) and while resting on a smooth, level asphalt surface. For rotorcraft equipped with wheels and/or landing gear struts, the maximum system deflections should be considered when determining the 5 inches of acceptable static ground clearance. The 5-inch ground clearance would only apply to original configuration of newly manufactured rotorcraft. However, a 3-inch ground clearance has been found acceptable and may be approved for skid gear equipped rotorcraft to account for the in-service permanent set allowed for skid gear members, (i.e., cross tube deflections allowed per the maintenance manual). Cable supported systems, (i.e., cargo hook installations) or dispensing systems utilizing flexible ducts (certain types of dry material dispensing equipment which may or may not be retractable) have been approved even though portions of the system may contact the surface during a normal landing.

(7) A number of rotorcraft are approved for external cargo operations that allow a gross weight higher than the approved internal gross weight limit. This difference is usually due to the allowable weight limit restriction of the landing gear. (The gear is not approved for the higher weight.) Those types of dispensing equipment, that can be loaded in flight to a weight that exceeds the allowable limit of the landing gear should incorporate a reliable means that rapidly reduces the total aircraft gross weight to within allowable landing gear limits. In most cases, this will involve jettison of the disposable load. The time interval for this operation should be demonstrated, and should not exceed a recommended 3 seconds from a level flight condition.

(8) A flight check or demonstration of the agricultural dispensing equipment installation is normally conducted. This flight check should also qualitatively determine that no hazardous deflection or resonance in the rotorcraft or dispensing system exists. This flight check should be conducted in accordance with the requirements of FAR 133.41.

(9) For rotorcraft certificated in dual categories, the inspection requirements of FAR 21.187(b) must be observed when converting from restricted to normal category.

c. Acceptable Means of Compliance.

(1) Analysis Method. Structural analysis (static) may be used if the structure is of a configuration for which experience has shown the method to be reliable. Structural

substantiation of tanks that are designed to contain liquid materials may be accomplished by pressure testing. For tanks or hoppers designed to contain dry material, (e.g., dust or fertilizer) static load tests may be used to verify structural integrity. The tank/hopper, mounting hardware, and support structure should all be substantiated to the load conditions specified by this paragraph considering the effects of internal fluid pressures when applicable.

(2) Static Tests. Static tests of tank/hoppers, mounting hardware, and support structure for each critical load condition may be accomplished using conventional techniques; such as, dead weight loading, whiffletree systems, and hydraulic rams. If tests of the tank and its mounting hardware are conducted using a test fixture representing the rotorcraft, the rotorcraft support structure may be substantiated independently by means of test and/or analysis. Static test loads should be applied in combination with associated internal fluid pressure loadings. The ultimate loads specified in paragraph AC 29 MG 5 should be sustained for at least 3 seconds without failure.

(3) Dynamic Tests.

(i) If the applicant elects to test to the load factors noted herein, the maneuvering and gust loadings will be considered to be adequately substantiated. For each condition, the critical volume and density of fluid should be used.

(ii) The tank and mounting hardware should support ultimate loads without detrimental permanent set or failure, respectively. The rotorcraft support structure may be included in the dynamic tests, or it may be substantiated separately via static test and/or analysis for each condition specified by this paragraph.

(4) Pressure Testing. Internal pressure loads may be applied using the water standpipe technique. Standpipe water height should be accurately computed for each critical spray tank static test loading. Pressure testing of spray tanks is not absolutely essential but is recommended for safety reasons. This testing will also determine whether the joints and connections are tight and will not leak in addition to determining any weak spots in the construction. Where spraying is done with highly volatile and flammable liquids, or where the tank has a return line, such as in an engine oil tank where the fluid is pumped back into the tank, it is recommended that the tank be tested for a pressure of 5 pounds per square inch. For other liquids, and where no fluid return line is used, testing to 3 ½ pounds per square inch should be satisfactory. There are many ways of pressure testing a tank, however, it is believed that the simplest and easiest method is to fill the tank with water and use a standpipe filled with water. A 1 1/8-inch pipe can be connected to the venting tube or one adapted to the filler opening. In either case the height of the pipe would be the same. For a 3 ½ PSI test of the tank the height of the water in the pipe would only need to be 8 feet and for a 5 PSI test only an 11 ½ -foot height of water will be needed.

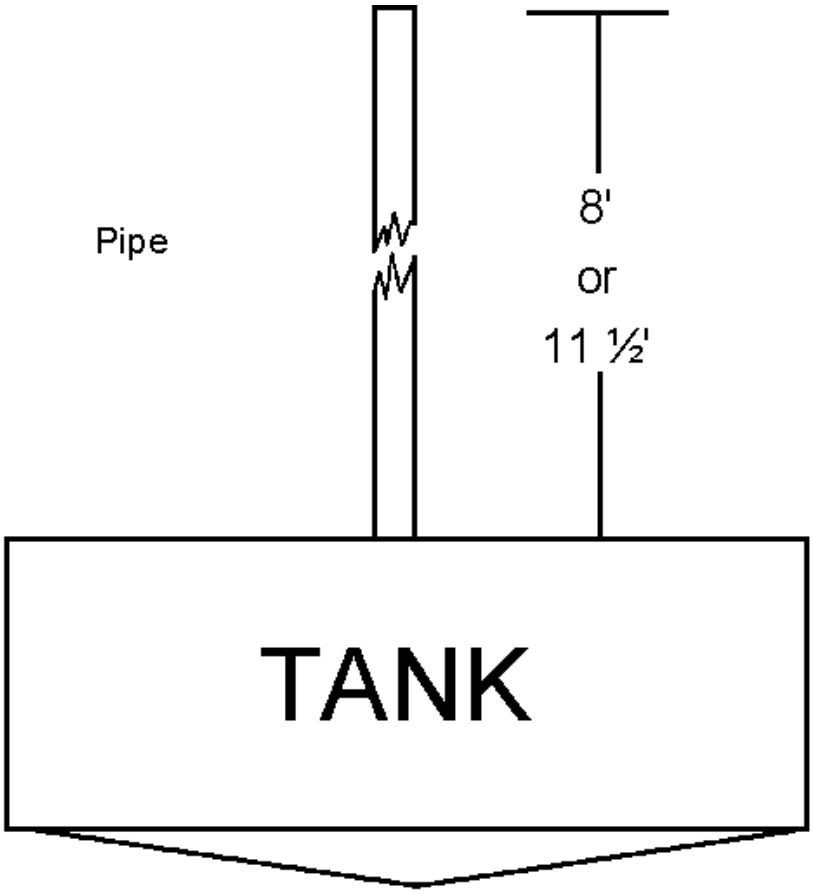

Figure AC 29.MG 5-2 Sketch of Tank Pressure Test